INTRODUCTORY LECTURE

DELIVERED TO THE

STUDENTS OF THE NATURAL HISTORY CLASS

IN THE

UNIVERSITY OF EDINBURGH

ON THE

OPENING OF THE WINTER SESSION 1855.

BY

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EDINBURGH:
ADAM & CHARLES BLACK, NORTH BRIDGE.
MDCCCLV.

PRINTED BY NEILL AND COMPANY, EDINBURGH.

INTRODUCTORY LECTURE.

In the honourable position on whose duties I this day enter, the painful is largely mingled with the pleasing; and how can it be otherwise? How can it be that I may not grieve in the loss of one whose friendship I esteemed among my most valued possessions, a loss which no lapse of years can replace, and which is only felt the more poignantly now that I am called upon to continue the work on which he had so brilliantly entered? Painful, too, is the consciousness of how utterly impossible it is for any one to supply the place of Edward Forbes; to grasp as he did, with all his unrivalled versatility, the wide range of natural science, throwing over its truths the charms of an imagination which never interfered with the sound logic of his judgment. Forbes has passed from among us; he has changed the doubtful for the certain, the obscure for the clear, the trammels of matter for the eternal freedom of the spirit. He has passed from among us, but long will his memory be cherished in the halls of this University; and long will his successors profit by the impulse which he had impressed on the science which he loved, an impulse which it is for them to carry onwards in its accumulating force.

The subject with which we are to be engaged in the lectures this day commenced is Natural History—Natural History in one of its widest and most comprehensive aspects. We are to be occupied, in the first place, with the study of the whole animal creation in every point of view in which it is possible to contemplate it; and, secondly, we are to devote no small portion of our course to the examination of the existing structure of the earth on which we live, and of its history through past

time. A field so wide will necessarily demand a large amount of our attention; but the close connection into which the varied subject-matter of the Natural History Chair is thus brought, will enable me to place before you a more comprehensive and grander picture of creation than would otherwise be possible, and will enable you to see in the organized and the unorganized world, not two entirely distinct and disconnected sets of facts, but one grand scheme, with all its parts mutually dependent on one another, and harmonizing into a perfect whole.

The framing of an introductory lecture is no easy task. It is expected that such a lecture must deal with generalities; and yet the generalities of science are not so varied but that they must have been already over and over again worked up in similar attempts. Perhaps, however, I cannot do better on this occasion than point out to you the nature and bearings of the subjects with which the present course is to be occupied, and the plan which it is my intention to pursue in their treatment.

The course of Natural History then, primarily and essentially, according to the universally received meaning attached to the term, involves Zoology. Zoology as a science, is one of wide-embracing comprehensiveness; the animal creation is its subject, but the animal creation viewed from a thousand varying points. In the first place, it will be my business to render you familiar with the *external forms* of the animated beings which surround us—with those prominent features which impress upon them an obvious character, by which they strike the eye even of the uninitiated. A correct knowledge of these external characters lies at the very foundation of all Zoology, and our attention must therefore be largely devoted to them. But to recognise their full value we must know their meaning,—we must seek for the key which is to interpret them, and this is only to be found in *structure* and *development*.

We are thus led to comparative anatomy, the life and soul of Zoology; without it I could bring before you nothing but a dry, uninteresting, and sterile mass of facts, presenting no mutual connection, and barren of ulterior consequence. It is

by its aid alone that Zoology has become what it now is, and almost every step in that great progress which it has made during the last quarter of a century has been effected by the scalpel and the microscope. What analysis is to the mathematician, these are to the investigator of the laws of organized existence. Possessed of them we can construct, as it were, a great equation, involving as its unknown quantity the hidden essence of life. And though we may not yet, and probably never shall, succeed in the actual determination of this great mystery, we can at least approach to a solution—we can simplify the formula—we can get rid of all which unnecessarily complicates it, until, by successive eliminations, we ultimately arrive at that simplest expression for a living being, that elemental cell which, in the present state of our knowledge, we must accept as the grandest generalization of Biology. Here, however, we must pause, content to have at least substituted an actual truth for a scholastic hypothesis,—for those illusory phantoms over which our forefathers dreamed away their lives in groundless surmises and visionary speculations, leaving the world no wiser nor better than before, except in so far as they afforded an example to be avoided of time wasted and talents misapplied.

But the zoologist must not consider his knowledge of an animal complete unless he has rendered himself acquainted with much more than its external form and internal structure. Its particular mode of life, the manifestations of those instincts by which it is adapted to the various physical conditions which surround it, and enabled to fulfil its mission in the external world, present a fertile field for careful observation and philosophic study. It is difficult indeed to imagine a subject more deserving of the attention of the zoologist than the psychical endowments of the animated beings which surround us—their wonderful constructiveness, their mysterious migrations, their societies, and commonwealths, and governments, their almost human passions and emotions—strange foreshadowings of a higher nature—to all these a portion of our course must be devoted if we would wish to render complete our picture of animated nature.

But the objects of our study present in the vastness of their

numbers a difficulty by which the young student is sure to be embarrassed, and which indeed at first must seem to him almost insurmountable. He looks abroad upon the world with its millions of living beings, as they throng upon his senses without order and without limit. He tries to study them *individually*, but feels that to obtain an adequate knowledge of any one, a lifetime would be needed. He attempts them in *masses*, but finds that he can make no general assertions of his ill-assorted groups. Lost amid the bewildering multiplicity of forms, he knows not where to turn, he is terrified at the labour which is before him, and is tempted to give up the study of nature in despair.

And this he might well do, were it not that there comes to his assistance an agent amongst the mightiest of all that have aided in the investigation of Truth—Classification lends to him a power by which, as at the utterance of a spell-word, the chaos which had surrounded him marshals itself in order, law becomes everywhere apparent, relations previously unseen weave themselves through all, and bind together the dissociated elements, and the external world, no longer a confused mass of uncorrelated objects and phenomena, now opens up before him as one beautiful harmonious whole.

To the principles, then, of a philosophic classification, and to the application of these principles to the animal kingdom, our attention must be largely devoted. The classificatory element of Natural History, indeed, is one which we cannot confine to any particular section or period of our course; it is one which must more or less extend itself through all the lectures to be delivered from this chair, as a pervading and regulating principle.

But the living beings which surround us are not scattered at random over the surface of the earth; we know that some are confined to one region, others to another, each finding in the place of its abode the physical conditions best suited to its organization. The labours of scientific travellers have now gathered together from almost every corner of the earth an immense accumulation of facts all bearing upon this most interesting subject of inquiry, and indications of certain great general laws regulating the geographical distribution of or-

ganized beings have been the result. The phenomena, therefore, of the geographical distribution of animals, and the elucidation of its laws, so far as these have been determined, will constitute another important section of our course.

For the exposition, however, of the laws of geographical distribution, there is needed an accurate knowledge of the physical conditions of the earth's surface—of those ever-changing phases of heat, and light, and moisture—of that infinitely varied conformation of mountain, and plain, and valley, of river, and lake, and torrent, and fen, of wastes of ice, and deserts of burning sand, of rock, and cliff, and island, and continent, and the great ocean rolling round them all—a variety to which that of organized beings is beautifully adapted, and by which their distribution over the earth is mainly limited and controlled. Physical geography, then, which renders us acquainted with this varied structure of the earth's surface, and with the meteorological conditions to which it is exposed, must find a place in a comprehensive course even of Zoology.

But organized beings are related to *time* as well as to space, and the phenomena of their distribution in time will constitute a topic of the very highest philosophical interest. We shall thus be led back to the remote ages of the past, to those early mornings of creation when beings altogether different from those which now dwell among us lived and multiplied amid primæval solitudes, and having performed their destined part in the economy of the universe, yielded up their places to others, which in their turn passed from among living forms, to be succeeded in other epochs by other races, until at last, in the great chain of succession, we are brought downwards to the days in which we are. But though those ancient tenants of our globe may have left behind no living representative, we have in their fossil remains an uncorrupted record from which the palæontologist can construct a history of the pre-Adamic ages of the earth. It is only by the study of this history, and of the strange beings which played their parts in the times which it records, that many a perplexing feature in the existing organic creation can be explained, and our view of living nature be rendered comprehensive and complete. Palæontology thus falls into Zoology and Botany as its proper sphere, and must

therefore constitute a portion of the zoological section of our course.

But as the distribution of organized beings in *space* cannot be understood without a knowledge of the superficial conformation of our earth, so an accurate conception of their distribution in time will require from us a knowledge of the deeper structure of its crust, and of those changes which physical agencies have through successive periods of time effected in the disposition of its parts. Physical Geology, therefore, whose complete treatment must also include Mineralogy, claims your attention along with Palæontology ; and thus, even though, in defining the duties of this chair, no special mention were made of any other subject than Zoology, I would deem those duties incompletely performed were the Professor debarred from the exposition to his class of the phenomena and laws of Geology.

From the general glance we have now taken at the nature and mutual dependence of the subjects which are to engage our attention during the ensuing lectures, it will be seen that Natural History is no mere pastime for the dilettante, no simple antidote to ennui ; that it is a department of human knowledge which must be studied deeply and earnestly if we would master the truths with which it is conversant, and appreciate their significance. There was a time when a low appreciation of the Natural History Sciences might have been well pardoned, when a true philosophy had not yet given an impulse and direction to the pursuits of the naturalist. Like other immature phases in the development of knowledge, this state of things was never destined to endure, and at the present day, and before my present audience, I feel that our science needs no apologist. We have only to reflect on the intrinsic value of its truths, their beauty and marvellousness, the high philosophy of its method, and the mental training involved in its study, to render it no matter of surprise that it has begun to occupy a prominent position in our Universities, and that Government has recognized its claims for qualification in some of the most important posts in the public service.

It is not my intention to occupy you for any length of time by dilating on the advantages of such studies to the Medical

Student, with whose special pursuits Zoology and Botany have from the earliest days of scientific medicine been linked in one inseverable brotherhood. I feel sure you all see as well as I do, the light which these studies must shed on a philosophic practice, by giving us enlarged views of organization, and of the great laws of universal life; and I know that it needs no laboured argument from me to convince you of how indispensable they must be as a preliminary curriculum to the more directly practical portion of your career; affording you an intellectual discipline where you are exercised in those habits which can alone make you great practitioners, and above all in habits of diagnosis, the very corner-stone of practical medicine, and of which the Natural History Sciences present the most complete gymnasium that ever has been or ever can be offered to the student.

The determination just adopted by Government, of introducing the Natural History Sciences into the examination for appointments in the civil service of India, is a thing altogether so new, and so full of ultimate results, that I cannot pass it over without an additional word or two. In a comparatively new and in many respects still unexplored country like India, where its advancement depends so much on our knowledge of its natural productions, it is manifestly of the very highest importance that the occupiers of public offices in that country should go out provided with such information, and trained in such studies as may enable them to assist in the discovery and development of these great natural sources of colonial wealth.

But independently of the direct application of Natural History knowledge to the development of the natural resources of our colonies, there is something in the intellectual training to which the candidate for a writership in the East India Company is thus subjected, and the peculiar habit of thought which results from a course of Natural History study, which must unquestionably prove of the highest value in the special duties of his office. And, indeed, for such duties we can scarcely too highly appreciate the habits which are thus acquired of enlarged, yet accurate and detailed observation, of the perception of the relative importance of attributes, and of the discrimination of closely-allied objects,—

the power which is thus bestowed of perceiving at a glance the proper grounds of physical truth,—the exercise, in short, of all those faculties which are involved in a comprehensive power of comparison, and of rigidly logical induction; but, perhaps above all, the training in the principles of a philosophic classification, for which the Biological Sciences afford the grand and almost exclusive school. In estimating the more purely practical tendencies of such studies, it should never be forgotten that Cuvier and Humboldt have been statesmen, and that no less an authority than Bentham has deliberately stated it as his belief, that were it not for Linnæus and Jussieu, and the other great masters of Natural History classification, the science of Codification, or the philosophic construction of the laws of a country, could never have arisen.

Upon the grounds, then, of simple utility, Natural History can put forth claims which all must recognise. Even though the immediate practical application of many of its truths be not at once apparent, this will afford no reasonable grounds for a cry of uselessness. Great truths, truths of mighty significance in the physical and social condition of our race, may be concealed within a fact apparently insignificant and unpregnant of result. Who could have dreamed of the import of that truth which quivered forth in the vibrating muscles of the dead frog's leg as it hung upon the wires of Volta? and who could have thought that there dwelt within those quaint old cups which are pointed out to the visitor of the Museum in Como, a promethean power which now strings the earth with a nerve-net and animates it with thought? Who could have pictured to himself the marvellous growth of that young giant force which your own Watt summoned into being, and which no sneer of the scoffer could destroy in its cradle?

But I am very far from believing that it needs any plea of mere utility, in the too generally accepted sense of this word, as synonymous with mere money value, to gain for Natural History studies a cordial reception from every lover of truth, and every well-wisher of the intellectual and moral advancement of his race. All honour be to those practical sciences which the stern reality of everyday life has called into existence, and which only yesterday received from my friend and

colleague, Dr George Wilson, so eloquent and true an exposition; but "man does not live by bread alone;" the philanthropist deems it not enough to minister to mere physical wants; he sees, indeed, that his fellow man must be housed, and fed, and clothed, but he sees no less clearly that there are higher elements of his being, the intellectual, the moral, and the religious—elements which link him with a purer order of existence, which make him the heir of immortality, the aspirant to heaven. Science is not to be despised, if we do not find in it a value which may be estimated by coin. Truth must not be weighed in the scales of the money-changer. There is another balance in which the labours of the honest-hearted student who loves the truth for truth's own sake, will yet be tried, and in that balance they will not be found wanting.

And now, gentlemen, to you I look for aid in the development in this University of a great Natural History School. The chair which had been held for half a century by Jameson, and for a shorter time, alas! than one brief year by Forbes, must not, if we can help it, fall from the reputation which these great names had conferred upon it. But, gentlemen, with you, even more than with myself, does it rest to maintain that reputation; and I have too much faith in the young men of our Universities, and trust too surely in that love of knowledge and truth by which I know that they are animated, to suffer me to believe that my confidence in the aid and co-operation of my pupils is misplaced.

It will not do for you to remain contented with mere routine attendance on the lectures to be delivered from this chair. The very nature of a professorial chair renders it impossible for me in many cases to do more than indicate to you those paths which you are to follow out for yourselves; but in this you will have every facility, and in conjunction with study in the field, I would urge upon you as frequent visits to the museum as you can spare time for, from other avocations. You may there spend many a profitable hour; the collection is large and varied, and worthy of this great University. We are now actively engaged in its arrangement, and in the disposition of the objects, so as to give it as much as possible of an illustrative and educational value; and though much still remains to be

done, which it is impossible to carry out with advantage until the additional space promised to us by Government be placed at our disposal, you will yet find that sufficient has been already achieved, especially in those departments which bear evidence of the philosophical views and judicious but uncompleted labours of our much-lamented friend Edward Forbes, to afford you valuable instruction, and abundantly repay the time bestowed upon its study.

While, therefore, it will always be my duty and my great pleasure to help you onwards to the best of my ability, your main reliance must be upon your own exertions; you cannot delegate to another the microscope and the scalpel, the dredge and the collecting-box. Neither can you delegate to another your right to judge for yourselves as to the validity of the facts here adduced, or to form from these facts your own conclusions. Far would I be from desiring that my pupils should receive with implicit faith the teachings of this chair, as if a professorial authority had invested those teachings with peculiar sanctity, and deprived you of all right to question them. I know well how prone we are to adhere to a favourite view; I know well, when after days or months spent in laborious observation with the microscope and the dissecting knife, or in attempting to interpret some involved and obscure geological phenomenon, the naturalist has at last arrived at some apparent fact, the sole reward of his expended time and taxed mind—a fact, too, it may be, of grand significance, if real—I know well how difficult it is then not to cling to his precious discovery—and that, too, in all sincerity—amid argument which, to a less interested advocate, must bring conviction of a fallacy. I have too much experience in such things not to feel the danger, and it is, therefore, that I would heartily wish to see the student turn from the expositions of this chair to the searching test of personal observation: "Nec te moveat Galeni auctoritas, naturæ et occulis credendum est, non Galeno."

To the students of Natural History, few places afford such facilities as Edinburgh for carrying out by actual work in the field, the principles expounded to him in the lectures of the class-room. In the geological phenomena of the surrounding

district, you have facts of the very highest interest, admirably adapted for the practical illustration of our lectures, and as affording examples of some of the most important agencies which have been at work in bringing about the present condition of our earth, presenting to the student a field for study, of unrivalled instructiveness. Then for the zoologist there is the Forth, with its copious and most interesting Fauna, so immediately accessible to you; the Clyde now so easily reached in these days of rapid transit, with its beautiful lochs teeming with zoological treasures; and the innumerable other bays and islands of the Scottish coast as yet little examined, but well fitted to repay the trouble of a careful exploration,—a concurrence of advantages which altogether afford to the student of marine zoology, facilities possessed, perhaps, by no other university in the world. And then there are your glorious Highlands, with their lochs and tarns, and unsullied streams, and wooded glens, and lonely moors, where the botanist has so often filled his vasculum, and where, in their almost unequalled variety of habit the zoologist may expect a harvest no less productive.

It is no small advantage of the studies for whose promotion this chair has been created, that they so often separate us from the city, from its distracting occupations and unprofitable pleasures, and carry us away into the purer country, where we may breathe the free air of heaven, and with invigorated bodies and refreshed spirits, hold commune with the beautiful and the good around us; where we may read in that wondrous book "whose pen," as it has eloquently been said, "is the finger of God, whose covers are the fire kingdoms and the star kingdoms, and its leaves the heather bells, and the polypes of the sea, and the gnats above the summer stream."

It is a great error to suppose, as has been done, that there is danger to scientific truth from our indulgence of the love of the beautiful, or the exercise of our imaginative faculties; or, on the other hand, that these must necessarily be extinguished within the atmosphere of our academic halls. So far from this being the case, I am persuaded that each derives benefit from the other. The painter or the poet is a better painter or

a better poet from being also a good naturalist; and to him the wide moor, and misty mountain, and ocean-worn cliff, will become invested with fresh beauty and fresh wonder when he has made himself familiar with the forms and the habits of the wild creatures which frequent them, and is no longer ignorant of those material laws which fling the mist over the mountain, and the heather over the moor, and have heaved up that granite mass, a barrier to the advancing billow, and a shelter to the sea-bird in its clefts. It is then he feels how full of thought is all this marvellous world; it needs not then the poetic fables of the Greek to people for him every glen and fountain, and wood and hill, with its appropriate genius, for the naturalist knows and feels, as none other can, the spiritual which is around him, and deep in his utmost soul rests for ever the unshaken faith, that on lonely mountain top, or barren shore, in the deep recesses of the silent wood, or on the boundless expanse of the never-tiring ocean, there dwells a Power and a Presence, dimly felt, it may be, through the gross medium of sense, but the true philosopher with hopeful, trustful confidence awaits the dispersion of the earth mist, knowing that in God's own time the twilight of conjecture must yield to the unclouded noontide of knowledge.

While by our noble schools of poetry and painting there is thus nothing but benefit to be gained from the scientific study of Nature, so, on the other hand, to the philosophic naturalist there is in the imagination a source of power which cannot be dispensed with. It is my full conviction that where the imagination is very deficient, there never can be a great naturalist. All experience is in favour of this view; some of the greatest discoveries in natural science, discoveries which have marked out great eras in its progress, have been made by men deeply imbued with poetic inspiration. The names Goethe and Chamisso will for ever link themselves with the highest philosophy of our science; and a Linnæus, an Oersted, a Humboldt, and a Forbes, are brilliant proofs of how largely the æsthetic faculty may dwell in minds which have made incursions the deepest and the widest into the realms of scientific truth.

I have thus, gentlemen, endeavoured to render you acquainted with the general plan and scope of the lectures to be

delivered during the present session from the Natural History Chair of this University; I have dwelt as far as I was permitted by the limits within which it is necessary to restrict a single lecture, upon some of the special characteristics of the studies in which we are about to be engaged, and on the claims which they have upon your attention, not only as professional but as general students. I have also referred to some of the peculiar facilities which this University affords for their pursuit; and it now only remains for you to enter upon them with clear heads and active hands, but above all with loving hearts. The Natural History Chair differs from most others in this University, in the fact that while the larger proportion of the students who attend it are engaged inspecia l medical studies, there is generally also a large number who are fitting themselves by the necessary academic exercises for other professions; while it is further probable that some of you will not have in view a preparation for any of the so-called learned professions, and will not be engaged in the pursuit of any special curriculum. One thing, however, is common to you all, that the close of your academic career only opens to you a world where not one of you can be inactive, a world of wide-embracing duties, of labour of the hand and of the labour of the head. Underlying all the teachings of our chairs is this solemn fact: I trust we all feel it, both pupils and professors; and much would I grieve to think that the day which completed your attendance on these lectures terminated your relation to your professor, or that you would cease to consider him at all times ready to aid you in your further pursuit of those branches of knowledge into which you have been here initiated. And whether it be that in struggling onwards, the harsh realities of life may throng fast and thick upon you, and the world become too strong for your mastery, or on the other hand, that the well-earned rewards of study shall be yours, and professional honours come to you unasked, we would truly regret to think that you could forget that there are still those in your old University, who can surely sympathise, and who may advise you in your difficulties, and who take an interest and a pride in your success.